

A U S T R A L I A N W H E A T B O A R D

South Australian Branch

Issued from Adelaide Office:

WHEAT GROWING IN SOUTH AUSTRALIA

These Notes have been compiled as ~~a source of information~~ for the benefit of students, teachers and others who desire information concerning the development of the wheat industry in South Australia since its establishment as a colony in 1836.

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Establishment of the Colony and the Wheat Industry Beginnings

The story of wheat growing goes back over ~~over~~ nearly 140 years to the time the first ^{workable} crops ^{were} in the colony was sown on the Adelaide Plain in 1839, when wheat was selling in the colony at twenty shillings per bushel.

Delving into the historical accounts of the industry's development during the time of the early settlers, reveals the often harsh experiences of the farmers in those early days. Settlers on the land were mainly English farmers but, later, emigrants from other European countries migrated to the colony and engaged in land settlement and cultivation. The early colonists learned the hard way that conditions in the colony were very different from those in the cooler and wetter climates of their homelands and, in the process, suffered much from mistakes, hard times and unremitting toil. For example, a very early lesson was that wheat plantings should be made in April and May and not be spread over the period from January to October. This was taught by the disastrous effects of the fierce summer heat which scorched those crops which had not been sown at the correct time. Ball smut made its appearance and farmers quickly learned to appreciate the wisdom of pickling in brine to control this disease. Later it was realised that the best method of pickling was by using copper sulphate (bluestone) which was first advocated by John Reynell in 1843 and was continued through to about 1916.

Although established by the South Australian Colonization Act of the British Parliament, assented to by King William IV on 15/8/1834, the official Proclamation of the colony did not take place until it was made by Governor John Hindmarsh at Glenelg on 28/12/1836, immediately after his arrival in the "Buffalo".

The colonization of South Australia was an experiment based on the three broad principles of the Plan evolved by the English theoretician, Edward Gibbon Wakefield (1796-1862), whose ideas found favour with those responsible at that time for British colonial policy.

South Australia's colonisation was unique in that only British subjects, who comprised mainly yeomen farmers, were initially allowed as settlers into the colony. No convicts were permitted and the colony's population at first was composed entirely of free persons.

Wakefield's principles, which were adopted from the outset, involved (1) the sale of land; (2) using the money received to sponsor emigrants; (3) the granting of some measure of self-government. One of Wakefield's main arguments was that the then current system of giving away vast tracts of land to settlers, as had occurred in New South Wales, had resulted in an

imbalance between land and labour. Land distribution ought to be restricted to increase the labour supply and this was to be done by selling land at a suitably high price to prevent all labourers becoming land owners.

Although Colonel William Light in 1836 had chosen the site of Adelaide as the capital of the colony and the location of the first settlement, for which land had been allotted in March 1837, the development of the colony stagnated at first because of constant clashes between Governor Hindmarsh and the Resident Commissioner, J.H. Fisher, who were provided with divided control in the Colonization Act. The survey of country land for settlers proceeded very slowly and the first ballot for country sections was not held until May 1838. Following the recall of Governor Hindmarsh and the dismissal of Commissioner Fisher in that year, the new Governor, Colonel George Gawler, set about speeding the work of surveying and by mid-1841 the area reached $\frac{1}{2}$ million acres. In that year, Governor Gawler was summarily replaced by Governor George Grey because Gawler had undertaken a liberal spending programme which incurred the displeasure of the Commissioners in London. In 1842, South Australia was declared an ordinary Crown Colony and thus lost the small measure of independence it had enjoyed. Despite the rigid economies which were imposed by Governor Grey, by 1844, establishment of farms and clearing and development work on the lands opened up by Governor Gawler had been absorbed by the colony's unemployed and continually arriving emigrants, resulting in the remarkable development of wheat growing, by that time, to an extent which made the colony self-supporting.

The Ridley Reaper (Stripping Machine)

Meanwhile, in 1843, a radical break-through occurred which enabled a considerable advance in agricultural progress. This was the manufacture of a successful stripper reaper designed by the colony's flour miller, John Ridley. The machine, which embodied the invention of a local farmer, John Wrathall Bull, consisted of a set of beaters working over a comb, by means of which the ripened ears of wheat were collected. Two horses pushed the machine from behind. The machine reaped 70 acres of wheat in 7 days, and was made in response to an offer of a prize of £40, for a machine which could help solve the colony's problem of the high cost of employing sickle reapers to harvest the wheat crops which, in 1843/44, covered ^{23,000}~~14,000~~ acres. Ridley did not patent his stripper, which thus permitted other machinery makers to take advantage of his machine and develop the improved stripper machines which subsequently became available in the colony. The benefit of the stripper and its lowering of production costs, spread in later years to all wheat growing countries throughout the world as various types of harvesting machines were developed.

Winnowers (See page 2a)

Development of Wheat Farms

South Australia was fortunate that it did not experience the problem with squatters, as was the case in the colonies of New South Wales and Victoria. These squatters had been able to acquire land and the rights of pasturage for cattle and sheep to the extent that agricultural farmers found great difficulty in obtaining land for settlement.

Winnowers

The earliest statistical data available which gives an indication of the extent to which mechanical reaping had progressed since 1843 shows the total area of ^{acres} wheat reaped in South Australia in 1860-61, was ^{373,672} ~~342,286~~ acres, of which 180,366 (66%) were reaped by stripping machines, and ^{93,396} ~~91,292~~ acres by hand.

Both means of reaping created a demand for winnowing machines to enable the farmers to separate out the grain from the harvested heads of the wheat and the accumulated chaff, dirt etc.

The first man to make winnowers in Adelaide was John Stokes Bagshaw who set up a workshop in 1838. He became famous for his farm tools, particularly his hand-operated winnowers of which thousands were made by his well-established business over the years up to the time of his death in 1880. Other manufacturers also produced winnowers, and other implements, to meet the needs of the continually expanding wheat industry.

The hand winnower was the only mechanical means of threshing out the grain, until powered threshers became available towards the latter part of the 19th century, and H. V. McKay's stripper harvester, which embodied a winnower, came into production after its invention in 1884.

The operating of the hand winnowers involved the farmers in wearisome, laborious, slow and dirty work but, nevertheless, was a big improvement ^{to} in the only alternatives, at that time, of flails, and other primitive threshing methods.

Development of Wheat Farms (see page 2!)

In South Australia, throughout the whole of its development, as the land was required for agriculture, it was resumed by the governments and sub-divided.

From the achievement of self-sufficiency in wheat production in 1844, through to 1850, things went well with most of the farmers in the new colony, and by this later date the area sown to wheat had increased to more than 40,000 acres. This reflected the development of farms on the more fertile, easily cleared, soils close to Adelaide, which had been brought about by the relatively low clearing costs and satisfactory yields, which generally averaged from 15 to 20 bushels per acre. By 1850, the local market was over-supplied, but Australian wheat was being exported to the British market following the abolition of the English Corn Laws in 1846. The repeal of the Navigation Act in 1849 resulted in better ships being available from America, which greatly reduced freight rates to English ports. Even so, competition on world markets was keen and prices generally were only a little over ^{three shillings} ~~3/-~~ per bushel. Nevertheless, local conditions caused price fluctuations. For example, it is recorded that despite 19 inches of rain in Adelaide in 1850, because of patchy falls on the farms, wheat yields fell to only 12 bushels, which caused a local shortage with prices rising to ^{seven shillings and six pence} ~~4/-~~ per bushel for that season.

Effect of Gold Rushes on Wheat Production in 1850's

In February 1851, the first of the gold discoveries was made by Hargraves near Bathurst in New South Wales and a few months later the Ballarat and Bendigo fields were also discovered in Victoria. These occurrences and later discoveries of gold ^{at other locations} in the Eastern colonies made a tremendous difference to the wheat industry in South Australia. Despite the fact that most able-bodied men, who were free to move, rushed off to the "diggings" and that there existed a serious shortage of labour and draught animals, wheat acreage in South Australia continued to expand and reached 162,000 acres sown by 1856. With a reduction in the quantities of wheat sown in other States in this period, particularly in Victoria and Tasmania, and the demands for food by the big increase in the Australian population which followed the gold mining boom from the mid 1850's, South Australia became the virtual granary of the Australian colonies.

It is interesting to note that the possibility of maintaining some balance between land, labour and capital, considered essential by Wakefield, disappeared in the gold rushes, which occurred soon after 1851. However, ^{as the} ~~that time also,~~ ^{modified time also,} the colonies of N.S.W., Victoria, Tasmania and South Australia were granted self government, which he considered such an essential requirement of successful colonization.

Wheat yields in South Australia in the 1850's, on the whole, were excellent and can be attributed to the fact that the farms in those early days were mostly in the fertile areas of reliable rainfall. Towards the late 1850's wheat prices fluctuated to a considerable extent but for the most part were above ^{seven shillings} ~~7/-~~ ^{as} ~~at~~ Port Adelaide.

In those years, South Australia's prosperity had improved following the discovery of copper at Kapunda earlier in 1843 and at Burra in 1845, where mining was carried on by men who heavily migrated to the colony and later by those who returned to South Australia in the late 1850's as the gold rush fever subsided.

Land Development North of Adelaide

The firm demand for wheat and attractive prices both within and outside the colony influenced a movement of settlers towards country north of Adelaide that carried less timber and was cheaper to clear than the land further south on which farms were first established. Thus, by the time the railway began to creep northwards from Adelaide, the Lower North areas of the colony were booming, with demand for land increasing as more men, mostly the sons of the earlier settlers, moved out from southern areas, anxious to obtain farms on the good arable land available. The railway reached Gawler in 1857, Kapunda in 1860 and pushed north to Burra by 1868. Land settlement also extended west down Yorke Peninsula to Maitland when the copper mines at Moonta and Wallaroo developed.

An impressive achievement was the expansion of the railway system by an additional 500 miles of lines which occurred in the 13 year period from 1869 to 1884, in a near frenzy of construction, under the impetus of the extension of wheat farming into the northern land areas. These railway lines formed a net work, as the wheat belt, at that time, comprised developed land areas no more than 65 miles/^{as the crow flies} ~~direct by rail~~ from the coastline to the inland margins of the wheat farms.

Wheat production in the colony was important in that period due to the absence of fences for enclosing sheep, with farm boundaries being marked with pegs. Because of the poor timber for posts and rails and the fact that the only wire available (heavy No. 4 gauge) was not suitable for sheep proof fences, most farmers were initially dependent upon the outcome of the wheat harvest. Shepherding of sheep, although common on big sheep runs, was not practicable or profitable on the typical small wheat farms.

Uneconomic Effect of Restriction of Farm Areas to 80 Acres

A sad feature of the early settlement stage in the colony was the restriction of the farm size to a mere 80 acres, which prevented families from making a reasonable living.

The South Australian problem initially arose out of the ignorance of conditions in the colony on the part of the English Colonisation Commission and their anxiety to restrict farm sizes, and avoid the error made in the eastern colonies of granting large land areas to a favoured few.

(Take in page 4a)

It was not until 1869 that the Government attempted to improve the situation by passing the Waste Lands Amendment Act, popularly known as the "Strangways Act", which ^{was intended} permitted the orderly expansion of agriculture into land areas suitable for farming which were at that time held under pastoral leases. This Act provided, in specified areas, for the sale by the Government by auction of farm blocks not exceeding 320 acres (129.5 hectares) with a 20% deposit and the balance payable at the end of 4 years at interest at 5% per annum. Each credit purchaser could obtain a maximum of 640 acres (259 hectares) all in a contiguous block, but had to occupy the land within 6 months and reside on it thereafter until the purchase was completed. Application had to be made in person. Although that Act introduced the innovation of a credit purchase system, and provided for larger farms, it failed to prevent the accumulation of large holdings by pastoralists by means of hired puppets known as "dummies".

However, with the passing of the Land Act in 1872 a healthy system of agriculture was established in South Australia which provided for farms of adequate size. The Act lowered the initial deposit to 10% of the land value and gave the buyer 6 years in which to complete his purchase, but required him to cultivate one fifth of the land each year. This system avoided the bitterness that existed in the eastern colonies between small farmers and wealthy squatters.

Extending the Northern Frontier of South Australia's Wheat Lands *Wheatlands*

An important era in the agricultural history of the colony occurred from 1869 to 1884, during which South Australia's wheat frontier was extended nearly 150 miles northwards of the limits reached in 1869, as a result of the relentless pressure of demand for rural lands. A splendid and well documented account of these developments is given in "On the Margins of the Good Earth" by D. W. Meinig. In this 15 year period there was a total increase of 1,935,000 acres in the cultivated land of the colony, of which 1,823,000 acres, or nearly 95%, was located in the new wheat areas opened up in the colony's northern parts. Statistics which illustrate the basis of this great demand for land show a population growth in the colony which rose from 185,626 in 1871 to 213,771 in 1876 and 279,865 in 1881. During the continuous expansion of land settlement in the north for a period of over 12 years from 1869, the settlers involved were mainly sons and daughters of the early pioneers. They accomplished their task of developing the new farms with the use of a minimum of capital and equipment and at a cost of much hard work. They suffered privations, a lack of amenities, insufficient building accommodation, and in many cases, particularly for the women, heart-breaking isolation as the larger sized farms were created in what was ^{previously} an empty land. The conditions encountered were quite different from those they had been used to on their home farms in the south.

The background to this development was that, in 1865, at the Government's request, Surveyor-General G. W. Goyder delineated on a map a "Line of Rainfall" showing the limits of the colony's agricultural land with reliable rainfall. From 1869, criticism of "Goyder's Line" increased as settlers, seeking rural land, sought to have the Government push the wheat frontier further north. They were misled by an exceptional run of good seasons in the period from 1870 to 1879 in which overall excess rainfall was experienced. Their challenge was successful in 1874 when the Government yielded to pressure, abolished Goyder's Line, and opened the entire colony to selection of land on credit, and even refused to renew pastoral licences for land formerly regarded as sheep or cattle country.

An ill-founded notion, commonly and widely held throughout the farming community during the 1870's, was that the climate could be changed by cultivation of the land, that is, that by some magical means, "rainfall followed the plough". Another fallacious idea held by some people was that the planting of trees in the drier areas of the colony would also increase the annual rainfall. Goyder rejected both of these ideas.

For a few seasons, good yields of grain were obtained from these northern areas due to seasons of unusually plentiful rainfall in these normally semi-arid regions. However, from about 1884, the period of settlement expansion ended, and an era of stagnation commenced, which lasted into the early 1900's. Statistics reveal that annual colonial wheat acreages, wheat production and exports, levelled off after 1884 and showed no significant rise for the next quarter of a century.

Contributing factors to the ~~static~~ ^{economic} condition of land settlement were the severe droughts of 1880-81, 1881-82 and 1882-83 in which latter season the average wheat yield dropped to the then lowest level in the colony's history at 4.2 bushels per acre. Throughout almost all the 1880's droughts persisted, and in the northern areas were severe in 1885 and 1888 when average yields fell to a disastrous 3.2 and 3.8 bushels per acre respectively. Locust plagues made farmers' conditions even more intolerable.

During 1883 and 1884 settlers forfeited and surrendered land totalled nearly 600,000 acres in consequence of the ruinous droughts. In 1884 the land legislation was amended to permit the settlers to convert their farms for credit purchases to long-term leases. By 1885 land forfeitures and surrenders of land in the northern counties, above the county of Stanley which is in the surer rainfall areas, reduced the total purchased land in these north counties by nearly one and a half million acres. Goyder was thus vindicated in refusing to alter his "line of rainfall" to include regions of unreliable rainfall.

Final Stages of Wheatlands Development

The static condition in which South Australian agricultural land development remained for a period of some 25 years from about 1885, was undoubtedly due partly to the low prices ^{obtainable} for South Australian wheat from its export markets, which were mainly in the United Kingdom, although exports ^{to U.K.} did decline to U.K. in some individual years. Another factor was the successful development of wheat farms in the Victorian Mallee districts with ^{the} greater depth of their top soils than occurs in the South Australian Mallee areas.

Attached to these Notes are 2 graphs entitled "Adelaide Wheat Prices" and "Annual Price of Wheat Since 1800 in United Kingdom" from which it can be seen that both show a trough formed by the general trend of prices, which decreased from about 1885 down to their lowest level just before 1900, and recovered to their former values from about 1910.

The last areas to be developed for wheat growing in South Australia were the Murray Mallee lands and Eyre Peninsula which are noticeably drier than the other agricultural areas of the State. Statistics show the mean average rainfall for the Murray Mallee and Eyre Peninsula for the past 60 years as between 12 and 13 inches (305 mm. to 330 mm.)

Wheat growing of significance was commenced on parts of Eyre Peninsula from about 1890, and by 1900-1901 the area planted to wheat had increased to 175,388 acres. Subsequently, over a long period, the arable acreage ^{on the Peninsula} was further extended to reach a peak area sown to wheat of 1,230,609 acres in 1930-31. (That is 30% of the State's total acreage). A big stimulus to development was provided during the 1920's because of the demand for rural land by soldiers returning from World War I, and ^{by} others, ^{aided} and by a sequence of good seasons and favourable prices during the 1920's.

The importance of Eyre Peninsula to the State's wheat industry can be gauged by the fact that the annual average quantity of wheat delivered by growers to the Australian Wheat Board at the Peninsula silos for the 10 year period from 1965/66 to 1974/75, was 40% of the total State deliveries with a peak of 48% in both 1967/68 and 1973/74.

Whilst there were a few farms established in the Murray Mallee areas by 1900, the major development came later, with some expansion between 1905 and 1910, but mainly during the period from 1911, throughout World War I (1914-1918) and afterwards, to reach a record area sown in the 1930-31 season, of 1,106,250 acres (26% of the State's total sowings). Perusal of rainfall records for the Murray Mallee and the Murray Valley statistical divisions since 1913 shows a considerable variableness in the annual rainfall pattern. The number of seasons which were drier than the annual average of about 12 inches are about the same as the number of seasons when rainfall was above average. Although more prone to droughts and near-droughts, at frequent but irregular intervals, than the rest of the State, in favourable seasons good wheat yields are obtained and these Mallee districts thus make a significant contribution to the wheat industry.

Although superphosphate and other manures were used to only a small extent on Eyre Peninsula ^{20/10} prior to 1900, wheat farmers came to realize that super was essential for successful ^{cereal} crops and for the growing of legumes. By 1910, on both the Peninsula and in the Murray Mallee, a big proportion of crops ^{were} being grown with super. Now-a-days superphosphate is used for almost all wheat crops grown in the State, and is applied with the seed *as the crops are planted.*

universally

In both of these drier areas of the agricultural lands farmers quickly came to realize that, to prevent falling yields, there was a need to adopt ley farming practices (medic and clover pastures in conjunction with crops) which provide soil nitrogen for crops, grown in rotation with pastures. Indeed, ley farming was similarly adopted throughout all agricultural areas in which crops ^{were} grown.

type Ley farming practices, and the avoidance of bare fallows on lighter ^{soils} in drier areas, has helped to reduce the danger and incidence of soil erosion in these more arid wheat zones. *simile*

Flour Milling

As the frontiers of land settlement advanced, villages came into being, which later developed into townships.

Some idea of the extent of this rural growth can be gauged from the fact that, in the years from 1869 to 1884, exactly 100 township sites were surveyed in the new wheat growing country in the north of the colony, and at several suitable places where small shipping ports were located on both shores of Yorke Peninsula. In addition, some 10 private townships were laid out.

Part of the basic community facilities established in almost all of the towns throughout the colony's agricultural areas was the flour mill, which provided an essential service by supplying flour for human consumption, and bran and pollard for animal and poultry feeds. The flour mills were also important as wheat buying agencies.

By 1880, a peak number of 117 steam-powered mills had been constructed at 101 different locations (4 were not working in that year) having 375 pairs of stones and employing 875 workmen.

The first steel roller mill in South Australia was purchased from England by Thomas & Co. of Port Adelaide and commenced operations in February 1886. From the late 1880's, and onwards, millstones for gristing were progressively discarded and steel roller type flour mills were constructed for the grinding of wheat.

At the present time there are 13 modern roller mills operating in the State, with a total gristing capacity of 29 tonnes per hour, which produce flour and wheaten products for local consumption and for export.

New Land Clearance Method

In 1867, about 3,000,000 acres of mallee scrub were made available for selection at concessional ^{rental fees, ~~annual~~ rates of 1/- to 1/6} per square mile for 21 years, with right of purchase. One selector, who took up an area of dense mallee scrub at Wasleys in 1868, was Charles Mullen who by 1876 had developed a system of land clearance which involved rolling ^{and} cutting the standing timber and bushes, and burning it off at a later stage. He scratched in his crop with a home-made harrow, and after reaping, burnt the straw and scorched the mallee shoots, which thus made the land available for the next season's crop. After several seasons the mallee stumps died. This practice spread throughout southern Australia and achieved the clearance of millions ^{of} acres of mallee scrub. Mullen pioneered his idea of rolling the scrub after he had built a scrub roller out of a discarded steam boiler. Some of the very strong mallees had to be "nicked" or axed down before rolling. Other settlers used many types of rollers, most of which were made from tree trunks. The popularity of the Mullenizing method was due to the reduced cost of land clearance because it avoided expensive, time absorbing, and arduous grubbing of the stumps.

Growth of Agricultural Education

During the 1880's, the realization came to many farmers that the low wheat yields, in the more reliable rainfall districts to the south of the northern lower rainfall areas, were due to the land fast losing its fertility, rather than to a lack of favourable weather conditions.

Following a disastrous attack of red rust in the wet, warm spring conditions of the 1867-68 season which ruined many wheat crops, a Royal Commission was appointed to enquire into the Disease of Cereals. Answers to the Commission's questionnaires to farmers revealed that almost all farmers sowed wheat after wheat, at least, every two or three years. Although some farmers appreciated the benefit of fallowing prior to sowing, and the value of rotational cropping, most of them were ignorant of correct practices and ^{were} in need of agricultural education.

Many years of growing anxiety, during which some farmers sold what they considered were their "worn out" farms and moved to others, culminated in the appointment of a Commission on Agricultural Education in 1875, whose recommendations included the formation of a Government Department of Agriculture, the appointment of a Professor of Agriculture, and the establishment of a model farm near Adelaide and other experimental farms.

After considerable delays, Professor D. Custance was appointed as the recommended Professor and arrived in 1881. During his appointment, which was terminated in 1887, the Roseworthy Agricultural College was established.

As a result of soil testing, he became convinced that a severe shortage of phosphate in South Australian soils was the prime cause of crop failures. In 1886, after four years of careful experimentation, he recommended superphosphate as the cheapest and best manure for wheat crops. Professor William Lowrie, who, in 1887, succeeded Custance, demonstrated the value of the fertilizer and popularized its use during his time at the College from 1888 to 1901 and earned the tribute that "no other man in South Australia had done more to make farming pay". Thanks to his work and the education of farmers, superphosphate made possible the opening up of the Murray Mallee lands to wheat growing and later those of Eyre Peninsula. Lowrie was a strong advocate of crop rotation and urged the practice of cultivating early and well-worked fallows to conserve moisture and eliminate weeds from crops. His teachings were widely adopted, being aided by an increased availability of better cultivation implements.

Benefits of Agricultural Education

The 45 year period from 1896 to 1941 saw big changes in the wheat industry in South Australia which reflected the impact of the educational influence exerted by men such as Professor Lowrie, and others at Roseworthy Agricultural College, and the work of Department of Agriculture officers in extending agricultural knowledge in relation to the wheat industry. In addition, there was a general improvement in farming practices which resulted from the educational efforts of the Agricultural Bureau, formed in 1888, which functions through the local Bureaux throughout the agricultural areas and at that time, ^{the Bureau was first introduced,} advised the Government on matters of agricultural policy. Factors which influenced the beneficial changes were:

- (1) Advocacy and the use of superphosphate and the adoption of early and well-worked fallows of wheat lands. By 1910-11 super was used with over 80% of the wheat areas sown. In 1930-31 the supered area was 90%.
- (2) The selection of improved varieties of wheat.
- (3) Efforts to control wheat diseases such as rust and smut.
- (4) The availability of improved farm implements, including harvesting machines. (H. V. McKay commenced production of his harvester at Ballarat in 1894).

The outlook for wheat growers, which at the turn of the century in 1900 seemed dark and almost hopeless for many farmers whose lands had become "run-down", by 1921 had changed to prospects which were bright and promising. Such was the effect of the super on the fertility of the soils and of the improvements in farming methods due to the educational influences which have been exerted on the farmers during this period.

Stump Jump Plough

In 1876 R. B. Smith, who farmed to the north of Maitland in South Australia, invented a stump jump plough, which was fitted with hinged beams to force the plough share back into the soil after it had jumped over the stump. He was unable to patent the invention, and this permitted the manufacture of stump jump ploughs by others, some of which were of improved design. The value of this invention to the colony and other parts of Australia where it was later used, cannot be calculated. Stump Jump ploughs enabled farmers to cultivate large areas of mallee scrub country which could not otherwise have been farmed. The cost of grubbing the stumps in those earlier times would have been from £2 to £7 per acre, which was more than the value of the land.

Clovers and Medics as a Source of Nitrogen for Wheat Crops

From 1910 onwards, although wheat crops were reasonably good over the more reliable agricultural areas, disturbing symptoms of future trouble were becoming evident. Many farmers noticed that their wheat yields were declining, despite well worked fallows and continued use of super, together with the sowing of improved wheat varieties. The long period of exploitive farming allied to the burning of stubbles, which prevented any organic matter build-up in the soil from the rotting of the straw, was beginning to have its effect. There was a great need to increase soil nitrogen, and to arrest soil erosion on many properties by the construction of contour banking to prevent soil run-off through water action. Nitrogenous manures were too expensive. Subsequent events were to prove that legume-based pastures provided the best answer to declining nitrogen levels and soil erosion.

The story of the use of annual legumes in Australia goes back to 1889 when A. W. Howard, who owned a farm at Mount Barker, discovered subterranean clover (Trifolium subterraneum) growing on a neighbour's farm at Blakiston, and later on his own property. Howard pioneered the use of this plant as a pasture and improver of the soil. In 1923, his son, Cecil Howard, developed and expanded the harvesting system of recovering the clover seed from the soil. Sub-clover, which derives its name from its habit of forcing most of its seeds into the soil whilst in the ripening stage, and which requires superphosphate for satisfactory growth, along with the other pasture legumes - the medics - proved to be of inestimable worth in developing the sheep and cattle industries, and in enriching the soil with nitrogen for cereal crops on neutral to acid soils.

Of greater significance to the wheat industry in South Australia was the appearance of another group of plants which had been introduced by chance. These were the annual medics - Medicago species, which were well suited to the lime-rich soils that are so common in the State's cereal belt. Recognition of their potential value occurred in the 1930's, when, for the first time, seed of barrel medic was harvested. It became apparent that the medics, like sub-clover, required adequate phosphate dressings.

For some years, however, only a few farmers took full advantage of these annual legumes. It was the rise in wool prices after World War II, and the boom prices received in the 1950's, which eventually caused needed changes in farming practices to a substantial extent throughout South Australia, and, indeed, in the other States also. Clovers and medics were grown increasingly to provide pastures needed as fodder for the sheep which were proving so profitable. This practice soon built up the fertility of the farms, which was reflected in improved yields due to the great improvement in the quantity of available soil nitrogen.

The extent to which the establishment of sub-clover and other legume pastures encouraged the wide-spread top-dressing of South Australia's grass lands with superphosphate is indicated by the fact that, by 1945, 705,000 acres were treated, and by 1957 the area had increased to 3,677,000 acres.

Continued research by agricultural scientists has provided farmers with a wide range of annual legumes for the varying soil and climatic conditions of the wheat belt. It is true to say that the present day profitable growing of wheat in South Australia would not have been possible without the development of clovers and medics, which prepare the land for the production of good quality grain with satisfactory yields, season by season.

Pickling and Grading of Wheat

In 1915, Alf Hannaford, a 24 year old farmer from Riverton, South Australia, made the first mechanical wheat pickling machine, which by agitation of a solution of copper sulphate (bluestone) or ~~wit~~ formalin, enabled the wet pickling of seed wheat as a protection against the fungus disease known as bunt or stinking ball smut. Up to that time farmers had to manually perform the back-breaking task of plunging bags of seed wheat into two containers or barrels of hot solutions of different temperatures, to treat the wheat, and afterwards drying the grain.

In 1922, Hannaford changed the design of the machine to enable dry pickling with copper carbonate, to give better protection against smut, but ~~this~~ which has since been replaced with other types of pickles developed by scientists in the search for improved chemical compounds to combat the disease.

When the financial depression hit the farmers in 1929, they could not afford to buy pickling machines. Hannaford met the situation by hiring his machines to farmers and about the same time commenced a service on the farms of seed grading, to clean out foreign seeds from the wheat, or barley or oats, as required, and at the same time pickling the seed as a protection against the smut fungus. The convenience and acceptable cost of the service resulted in wide-spread engagement of Hannaford's in grading and pickling on farms both in South Australia and in other States. Such practice is now a permanent feature of Australian agriculture because of its beneficial effect ~~in~~ increasing crop yields by removing the competition from weed growth to the wheat, barley or oats, which would otherwise occur if the foreign seeds had not been cleaned out before the cereal crops were planted.

this service through to the present time. — Over the years this has proved of great value to Australian wheat farmers and an important factor in increasing crop yields, whilst reducing the amount of foreign seeds in cereal crops.

The Marginal Lands Problem

In 1930, as a result of the drastic reduction in wheat prices which was due to the world financial depression operating at that time, the problem of avoiding financial ruin to settlers on marginal lands arose in the four mainland States. In South Australia, the problem can be summarized as the *inability* of some 1276 farms with a total area of 1,695,000 acres being worked as successful financial businesses because the average farm sizes were far too small. *As the wheat yielding Committee considered these areas sufficient for only 65% of the* Marginal lands were defined by a Government Committee of Enquiry, which reported in 1947, as being those lands which had been made available for wheat growing but, due to the combination of inadequate rainfall and unsuitable land, had been proved unsatisfactory for wheat production as a major operation.

Eventually Commonwealth finance was made available and used by the State Government to put into effect a scheme for the re-allotment of farm areas. The cost of purchasing farms for this purpose was some £600,000, and the average cost of adjustment per farm was £4,039. The combined effects of improved water availability and fencing, and the increased wheat and wool prices which rose in 1948, and the boom in wool prices in 1950, enabled the mixed farming operations on the rehabilitated marginal lands areas to be both profitable and successful. Special action was taken to rehabilitate badly eroded and derelict farms, which was *successful* over a period of several years under good management and correct regeneration practices, *including* ~~which included~~ the use of cereal rye to consolidate *drifting* wind-eroded soils.

Selecting Improved Wheat Varieties

In the earlier years of the colony the wheat varieties grown were ~~these~~ obtained from England where the climatic and soil conditions were quite different from those in South Australia. William Farrer, the famous pioneer wheat breeder, when commenting on their unsuitability to Australian conditions, said of these varieties that "they yielded more of disappointment than of profit, being too late in ripening for our climate, resulting in their ears being blasted and their grain pinched by the hot winds of our summers. When the rust pest gained a footing in the country farmers lost heart and the industry ceased to make progress and even declined".

By selecting off-types of wheat, naturally occurring in their crops, three South Australian farmers, Ward, Gluyas and Steinwedel, made available the first varieties which were adapted to Australian conditions

and these contributed significantly to the development of the wheat industry, both in South Australia and in the other colonies. A decision of the then South Australian Commissioner of Crown Lands (Mr. T. Playford), who acted on the advice of G. E. Wilson, a farmer of Terowie, to instruct Dr. Richard Schomburgh, in 1881, to import the white wheat variety "Du Toit", had far-reaching beneficial effects. Dr. Schomburgh distributed the seed in very small quantities amongst farmers throughout the colony. Amongst them was James Ward of Nelshaby near Port Pirie, who planted a handful of the seed in his garden. Apart from a few ears, the plants were severely rusted and produced no grain. Ward collected the grain from the sound ears and over the next four years multiplied this selected wheat to 233 bags. The variety was named "Ward's Prolific" and was ^{later} distributed widely throughout the colony where it became popular because of its resistance to rust and ability to yield well under low rainfall conditions, even though its hard dark coloured grain made it unpopular with flour millers.

A German farmer named Steinwedel, at Dalkey in South Australia, in 1884 selected the seed from a few tall plants found in a crop of the American variety, "Champlain's Hybrid", which had yielded poorly. This early maturing variety was named "Steinwedel" and was popular from 1890 to 1910 in the drier parts of the Australian wheat belt. Although susceptible to rust, this wheat was drought-resisting and outyielded the other varieties ^{grown at} of the time, despite a tendency to shed its grain. It was used as a parent variety by wheat breeders in New South Wales and South Australia as a source of yield capacity and drought resistance in later developed varieties, which included "Ford", "Bobin" and "Sword".

In 1884, J. D. Custance, Principal of Roseworthy College, brought to South Australia the variety "Early Baart" from South Africa. This variety was later used as a parent wheat to develop distinctive varieties including the prominent wheats of several years ago, namely "Sword" and "Rapier".

In 1890, another South Australian, ^{Richard} R. Marshall, a farmer of Wasleys, who was a contemporary of Farrer in his later years, and who became a famous Australian wheat breeder, crossed "Ward's Prolific" with a Purple-Straw cultivar. The resulting progeny was a white-grained, late maturing type with strong purplish medium dark straw, which was named "Marshall's No. 3". By 1910 it had become one of Australia's leading varieties. Marshall also produced the very popular "Yandilla King" variety, released in 1907 and later acclaimed up to the 1920's as being among the best wheats produced in the Commonwealth, which was obtained by his crossing a white strained selection of his "Marshall's No. 3" with William Farrer's Indian-Fife wheat "Yandilla". (S.I. Macindoe).

In 1894, from a field of "Ward's Prolific", H. J. Gluyas of Port Germein selected a few white grained types which were noticeably different from the rest of the crop. Two of these proved to have rust resistance, and these he multiplied for distribution amongst other farmers. The variety was named "Gluyas Early" (also known as Gluyas), and achieved wide popularity throughout the Australian colonies because of its drought resistance, being second to Farrer's "Federation" variety from about 1910 to 1925.

A major benefit derived from the selection of all of the white wheat varieties described above was that wheat growing was extended into the regions of lower rainfall in the mainland colonies.

During the last half a century, wheat breeding has been largely in the hands of the State Departments of Agriculture and the Universities of Australia. In South Australia, Roseworthy Agricultural College has established a great reputation, and the Waite Agricultural Research Institute has recently re-entered the field of wheat breeding.

Wheat Marketing and Bulk Handling Methods

Expanded from 1914-15 to 1930-31

Early in the 1900's widespread dissatisfaction with the method of marketing wheat in South Australia, existed amongst growers. Many farmers depended almost entirely on wheat for their income, as, on the smaller farms, very few sheep or other livestock were kept. Farmers were convinced that they were suffering several handicaps compared with farmers in the Eastern States, and that financial returns from the sale of their wheat were too low.

A Royal Commission, appointed in 1908, to investigate methods of marketing wheat in South Australia, reported that a lack of competition existed between wheat buyer merchants because they had reached an "honourable understanding" between themselves to protect their interests, which enabled them to exploit the unorganized farmers. In spite of the Royal Commission's finding that merchants and millers were "farming the farmers", no effective reforms resulted. The Commission acknowledged the virtues and possibilities of a bulk handling system for grain, but found that the apathy of growers, the unfriendly attitude of wheat shippers, and the establishment costs were factors against its acceptance.

In 1914-15 a comprehensive scheme for bulk handling of grain, prepared by Canadian consultants, Metcalf & Co. Ltd., failed to get Parliamentary approval.

During World War I an Australian Wheat Board was appointed with powers to operate compulsory wheat pools and had sole responsibility for marketing of wheat. Such pools were conducted from 1915-16 to 1920-21 inclusive. A voluntary co-operative pool, which was formed after the war ended, although initially popular with 36% of the State's marketable wheat being handled in 1921-22, increasing to 60% in 1930-31, virtually failed later on because of merchants' competition, which forced the volume of wheat handled down to 18% in 1933-34 and to only 1.5% in 1936-37 and 4% in 1938-39.

An attempt
A move in 1922 by a local co-operative company of farmers entitled "Farmers Bulk Grain Co-op. Ltd." to get approval from Parliament to establish bulk handling was unsuccessful.

It was several years afterwards that the first move by farmers to unite and fight for their rights occurred when, at a meeting at Borrika in the South Australian Murray lands, in 1927, the S.A. Wheatgrowers Protection Association was formed (later changed to S.A. Wheat & Woolgrowers Association).

South Australian
The Federal Labour Government in 1930 introduced legislation for compulsory wheat pools, providing for an Australian Wheat Board and State Marketing Boards and for a guaranteed price to growers, with control being vested in the wheatgrowers themselves. *The* Wheat Marketing Bill *was rejected* in the Senate where the Opposition held a majority. A Bill introduced in 1931, which did not include a price guarantee, suffered a similar fate.
In 1931 the Association reached two historic decisions which led to the establishment of the very successful orderly marketing scheme for wheat throughout Australia, and to the construction of the up-to-date bulk grain silo system which serves the cereal growers of South Australia today.

The Association's decision in relation to wheat marketing took the form of a resolution adopting a wheat industry stabilization scheme, as prepared by J.E. Maycock, one of the Association's leaders. Their objective was partially achieved when the Commonwealth Government in September 1939 appointed the Australian Wheat Board, under the defence powers in the Australian Constitution, to operate compulsory wheat pools during World War II and the

3 transitional years thereafter. Final success was reached in 1948, 17 years after the South Australian Association's initial decision, when the first wheat industry stabilization plan was enacted by the Commonwealth and State Parliaments following an Australia-wide poll of growers which resulted in a majority in favour in each State. South Australian wheat industry leaders took a prominent part in the negotiation of the plan, under the stimulus of the bitter experience of distress among the farming community during the Depression in the 1930's, and the effect of some 3,000 wheat-grower bankruptcies over 10 years, at that time, because of low and ruinous wheat prices.

The second 1931 decision of the Association was a resolution that bulk handling facilities be provided for wheat in South Australia. In that year, the Parliamentary Standing Committee on Public Works was requested to investigate a State bulk handling system for grain and reported in 1934 with a favourable recommendation which did not gain Parliament's support. There were ^{further} ~~several~~ unsuccessful attempts to obtain enactment of bulk handling by the State Parliament from 1934 until, eventually, in 1955 the Bulk Handling of Grain Act was passed. Earlier, on ^{3/1/54} ~~7/2/54~~, a co-operative company of wheatgrower members, known as S.A. Co-operative Bulk Handling Ltd., was incorporated.

The practical demonstration of the successful operation of a bulk export silo at Ardrossan by the Australian Wheat Board, which was opened in November 1952, and used the Broken Hill Pty. Co. Ltd. shipping conveyor to load overseas vessels, was a crucial factor in influencing the introduction of the bulk handling system for grain in South Australia.

F.A.Q. (Fair Average Quality) Wheat Grading System

South Australian wheat merchants (exporters), in 1888, first originated what was later known as the Fair Average Quality system of marketing wheat. Originally termed the "Standard sample" method, the merchants acted in response to requests from overseas buyers, at that time, for some satisfactory ^{method} standard by which to determine the quality and standard of wheat being traded, *which would reflect reasonable differences in the wheat.*

The F.A.Q. system was adopted in Victoria in 1891, by New South Wales in 1899 and by Western Australia in 1905 and served as the widely recognized ^{method} method of marketing Australian wheat for upwards of 86 years until the Australian Wheat Board, from Season 1974/75, replaced F.A.Q. wheat with the Australian Standard White Class, which has a separate standard for each State. For example, A.S.W. wheat in South Australia is described as A.S.W. (S.A.).

Broadly speaking, the F.A.Q. system involved drawing a representative sample of wheat, in this grade, from every delivery point in the State from which the wheat was to be exported. The sample quantity of wheat used was proportionate to the total seasonal deliveries at each receipt point. The wheat in the samples was thoroughly mixed to obtain a fair average sample as a basis on which sales of wheat for the relevant season were made. By means of a chondrometer, the density of the sales sample was then determined, which was known as the "bushel" or test weight.

A weakness of the system was that prices payable by buyers were no higher for wheat supplied which was better than the sample used as the basis of sale, and thus did not provide an incentive to farmers to thoroughly clean out foreign matter and unmillable material from their wheat before marketing it.

The various State Wheat Standards Committees continue to follow the old F.A.Q. sampling method in each State in determining the standard samples used for the sale, for export, of Australian Standard White wheat each season.

Soil Nitrogen - a Key to Successful Wheatgrowing
in South Australia

Wheat statistics over the past 55 years, since 1921, reveal the dramatic success achieved in expanding the rate of wheat yields through the agronomic practice of providing soil nitrogen for crops by growing legumes in crop rotations. This success has been aided by the planting of improved wheat varieties and by increased efficiency in wheat production methods and improved farm machinery.

The rate of wheat yields for the 10 year period 1921/22 to 1930/31 at a season average of 0.67 tonnes per hectare (10 bushels per acre) was improved by 73 % to 1.16 tonnes per hectare (17.3 bushels per acre) for the 10 years from 1966/67 to 1975/76.

The best rate of yield for South Australia, so far, was in 1960/61 when a rate of 1.59 tonnes per hectare ^(23.6 bushels per acre) was achieved.

This remarkable improvement in crop yields is reminiscent of the recovery of wheat yields back in the early 1900's, when a general increase ~~on farms~~ in the use of superphosphate ^{on farms} for wheat crops from 1905 more than doubled the average wheat yields experienced in the preceding 10 year period from 1896 to 1904.

As explained in these Notes on page 9 the benefits of the legume-cereal crop rotational practices have spread throughout other Australian States, and also to New Zealand ~~but has not been identified~~.

Conclusions

To South Australia goes the credit for the adoption of patterns of land use, in agricultural areas of reliable rainfall, which has placed its rural economy on a firm footing, due to the development of grain-livestock farms of viable proportions and adequate size.

Wheat farmers from South Australia's older established wheat growing areas were prominent among the pioneer settlers on Eyre Peninsula, the Murray Mallee, and in the Mallee and Wimmera districts of Victoria during their main expansion periods. South Australian wheat farmers also moved out to Western Australia, New South Wales and even to Queensland where they engaged in the pioneering development of wheat farms.

Thus, the South Australian wheat farming experience, extending virtually from the time of the first mechanically harvested wheat crop in 1843, and through ^{both} the earlier ^{and later} formative years of the industry, exerted a pervasive influence in the other States and contributed, to a major extent, to the growth of the great Australian wheat industry and to its present competitive position in world markets.

Original inventions and innovations in farming practices provided throughout South Australia's history have led to five major achievements.

These are: mechanization of the industry; suitable wheat varieties; the use of superphosphate; the adoption of fallow cultivation; and the development of nitrogen-rich soils through the use of legumes which provides one of the basic requirements for profitable cereal-pasture rotations.

Acknowledgements

Much of the material for this historical summary has been taken from "Rural Development in South Australia" by W. S. Kelly.

Some data has been used from "The Wheat Industry in Australia" by Callaghan & Millington, "Digging Stick to Rotary Hoe" by Frances Wheelhouse, "On the Margins of the Good Earth" by D. W. Meeking, "The Australian Wheat-Growing Industry" by Edgars Dunsdorfs.

These sources of information are gratefully acknowledged.

MAP TO ILLUSTRATE GOYDER'S LINE.

LINE DRAWN IN 1865

LINE DRAWN IN 1882.

ROUTE TAKEN IN 1865

TETULPA

33°S

POSITION of the LINE in
PINAROO DISTRICT in

1865 PLAN, Rus:

— IN 1882 PLAN, Rus: ++++++

— RELATIVE POSITIONS of HUNDREDS
of COTTON, ZEWS, PARILLA
& PINAROO, as marked.

34°S

1865

1902

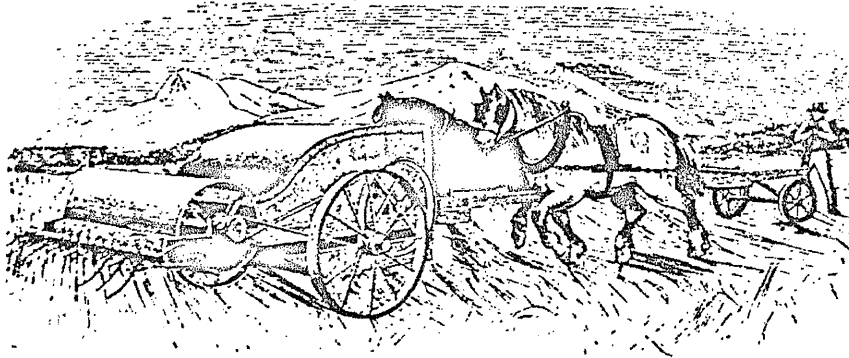
35°S

C. B. PA. P.
1882

Old map illustrating Goyder's Line. Note some differences from today's spelling
of place names.

beats connected with the carriage wheel axes. Horses were attached to a pole at the rear of the Stripper and, as they pushed it through the crop, the comb gathered the wheat heads only. The beaters knocked the heads into a box-like structure.

This new machine had the remarkable advantage of applying a completely different process of harvesting grain to any machine then in use anywhere else in the world. Before this, the entire stalks of the plant were cut, gathered into bundles by hand and tied into sheaves which were then arranged in stooks in the field to lose moisture.

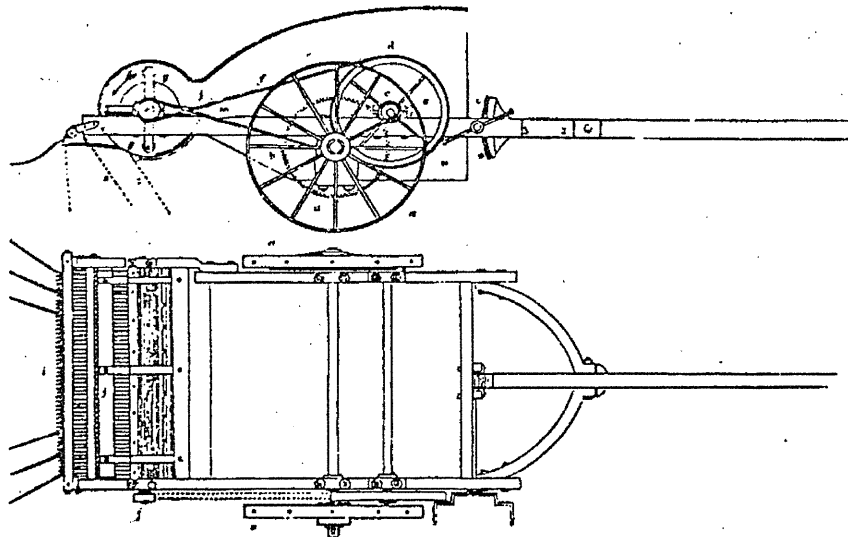


The original Stripper of 1843, then known as a Reaping Machine when first invented in South Australia

Who then really did design this machine? Ridley, Dr. Sutton tells us, "failed with his first machine when tested in October, 1843, so he made another of different design and ran trials in November, 1843, this time with success . . . this machine was the forerunner of a machine which subsequently

grain ~~thence~~ from the ears of the standing crop, thus eliminating the reaping operation contemplated by Ridley."

Bull put forward his claim as the originator of the "comb and beaters" in March, 1854, and he supported his claim in letters to newspapers on March 10. Few people remembered that Ridley's first invention was a reaping or cutting machine. Now his second machine thrashed the wheat with comb and beaters.



The first Wheat Stripper, invented by John Wrathall Bull and made by John Ridley in Adelaide

There are many records to show that Bull introduced the idea of comb and beaters. Bull himself wrote in *Early Recollections and Experiences of Colonial Life*:

"I will now give an account of my own experience in the harvest of 1842-43 and in the conveyance of the crop to market. Prices had fallen considerably and buyers were scarce. My crop was in condition for hand-reaping before the end of December, but I could not procure reapers before

Fig. III

ADELAIDE WHEAT PRICES

1861/2 - 1933/4

(Taken from Report of Commonwealth Parliament
Royal Commission on Wheat, Flour and Bread
Industries, appointed 25/1/34)

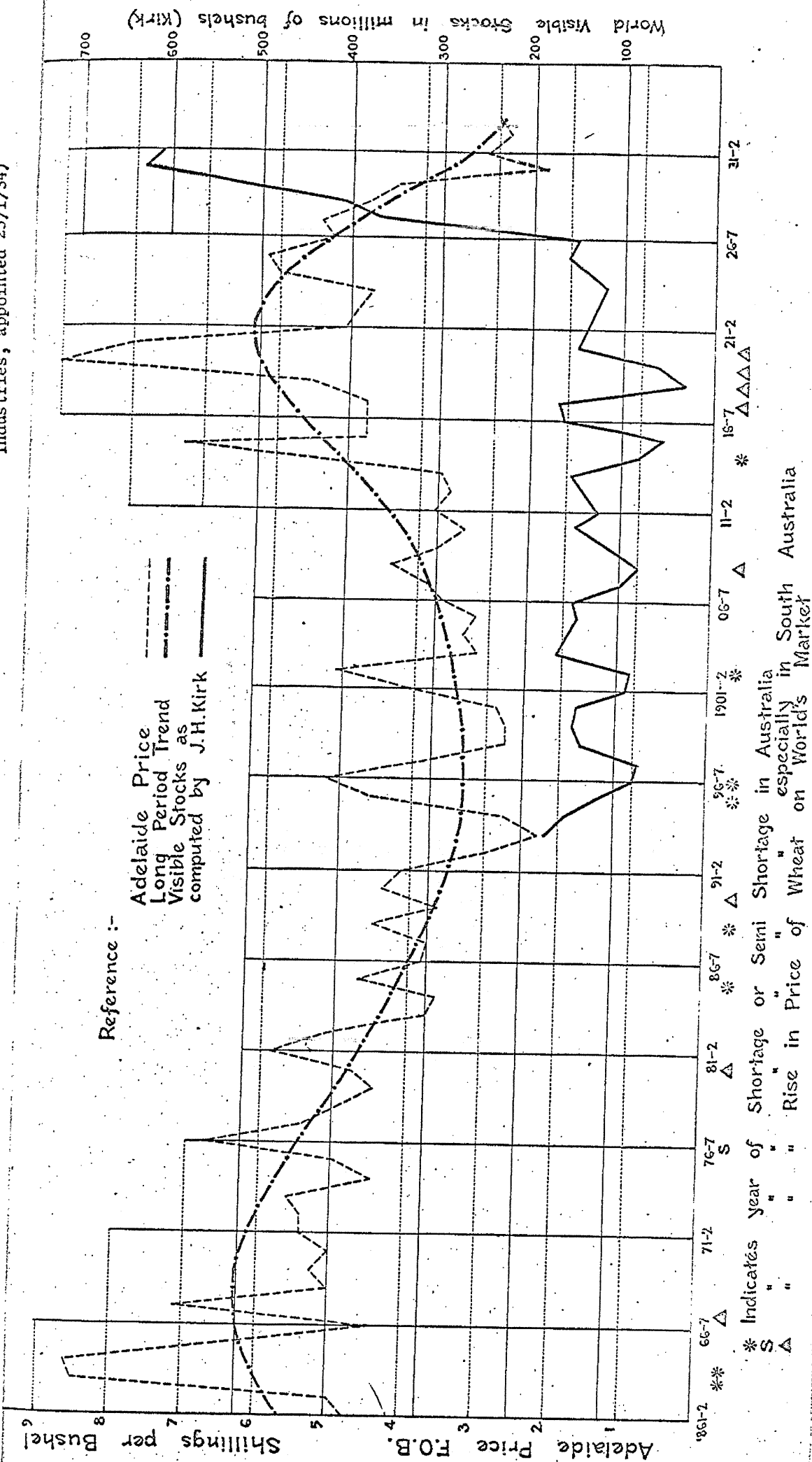
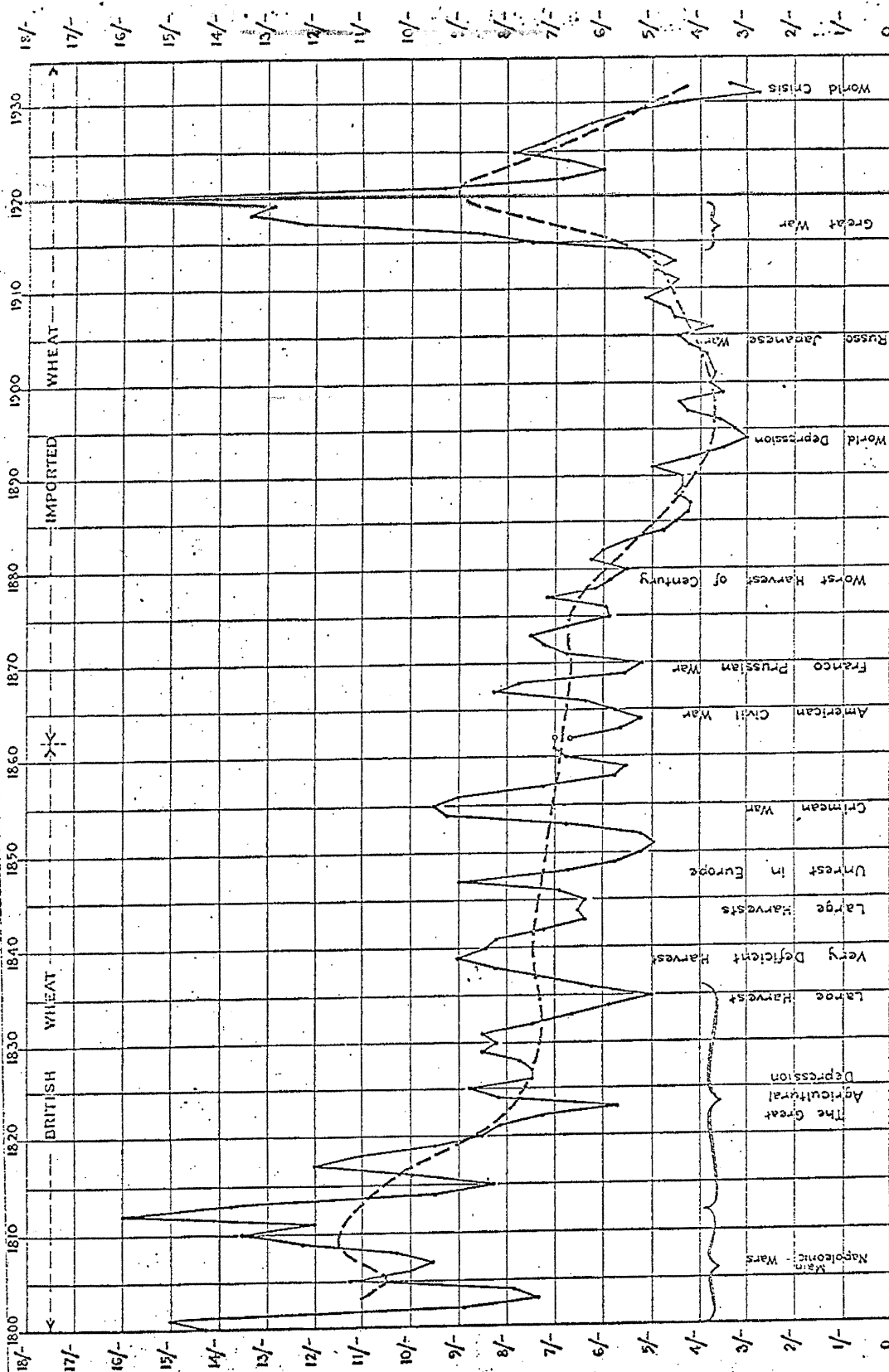


Fig. 11 THE ANNUAL PRICE OF WHEAT SINCE 1800
IN UNITED KINGDOM

(Taken from Report of Commonwealth Parliament
Royal Commission on Wheat, Flour and Bread
Industries, appointed 25/1/34)





Sketch by A. C. B., 1865: Coyder "in pursuit of rainfall."